Economic costs of post-natal depression in a high-risk British cohort

STAVROS PETROU, PETER COOPER, LYNNE MURRAY and LESLIE L. DAVIDSON

Background Post-natal depression is a common condition that can result in distress for the mother and deleterious effects on the development of the infant.

Aims To estimate the economic costs of post-natal depression in a geographically defined cohort of women at high risk of developing the condition.

Method Unit costs were applied to estimates of health and social care resource use made by 206 women recruited from antenatal clinics and their infants. Net costs per mother–infant dyad over the first 18 months post-partum were estimated.

Results Mean mother–infant dyad costs were estimated at £2419.00 for women with post-natal depression and £2026.90 for women without post-natal depression, a mean cost difference of £392.10 (P=0.17). The mean cost differences between women with and without post-natal depression reached statistical significance for community care services (P=0.01), but not for other categories of service. Economic costs were higher for women with extended experiences of the condition.

Conclusions The results of this study should be used to facilitate the effective planning of services by different agencies.

Declaration of interest None. Funding was provided by the NHS Executive South East, the Department of Health and the Tedworth Charitable Trust.

Post-natal depression is a common condition thought to affect approximately 13% of women during the early months following childbirth (O'Hara & Swain, 1996). Women with post-natal depression are likely to experience persistent feelings of inadequacy and hopelessness (Godfroid & Charlot, 1996), as well as an increased propensity to terminate breastfeeding early (Cooper *et al*, 1993) and to have difficulty with infant sleeping routines, infant crying and demands for attention (Seeley *et al*, 1996). Furthermore, these problems in the early mother–infant relationship arising in the context of post-natal depression appear to set in train a process leading to suboptimal cognitive and emotional development of the child. This can be manifested as insecure attachment to the mother (Murray, 1992), impaired socio-emotional functioning (Stein *et al*, 1991), cognitive deficit (Cogill *et al*, 1986; Hay *et al*, 2001) and behavioural disturbance both at home (Murray, 1992; Murray *et al*, 1999) and in school (Sinclair & Murray, 1998). Although the cognitive, emotional and behavioural consequences of post-natal depression are likely to affect several areas of the economy, no estimates of the economic implications of the condition have been reported to date in the published literature. The objective of this study was to estimate, for the first time, the economic costs of post-natal depression in a geographically defined cohort.

METHOD

An economic study was conducted in which we applied unit costs to resource-use data collected alongside a longitudinal study of women at high risk of developing post-natal depression. The economic study was conducted from a public sector perspective and covered all aspects of health and social care provided to the mother and infant between delivery and 18 months post-partum. The economic study was not able to include costs borne by the women themselves and their informal carers, or the costs of lost productivity.

Study sample

Consecutive primiparous women attending antenatal clinics at 26–28 weeks of gestation in the town of Reading, south-east England, during the period May 1997 to April 1999 were screened using a predictive index for post-natal depression (Cooper *et al*, 1996). The index contained 17 items and covered women's experiences of pregnancy, previous depressive episodes, relationships with their current partner and mother, educational qualifications and satisfaction with the area lived in. Women identified as being at high risk of developing post-natal depression (index score $\geqslant$24) were approached by a member of the research team and their consent to participate in the study was sought. Consenting women resident in Reading South were entered into a randomised controlled trial of a preventive intervention for post-natal depression delivered by trained health visitors, whereas those resident in Reading North were observed over the same study period and assessed using the same clinical, psychological and economic instruments. Further details of the design and conduct of the trial conducted in Reading South are reported elsewhere (Cooper & Murray, 1996). For the purposes of the economic study reported here, all economic data were pooled across the two geographical areas and included women in the trial and in the observational study. An independent researcher, blind to intervention status, assessed the mental state of all women at 8 weeks, 18 weeks, 12 months and 18 months post-partum using the Structured Clinical Interview for DSM–III–R diagnoses (SCID–II; First *et al*, 1995). Ethical approval for the study was obtained from the relevant local ethics committees.

Resource-use data

Data about the use of resources for all women enrolled in the study and about the subsequent care received by their infants were obtained during the course of three face-to-face interviews with the women. The interviews were held at a university psychology department at 18 weeks, 12 months and 18 months post-partum. As part of all three interviews, the women

https://doi.org/10.1192/bjp.181.6.505 Published online by Cambridge University Press

were asked a series of structured close-ended questions by one of two trained interviewers. The interview held at 18 weeks post-partum recorded total service utilisation over the previous 18 weeks, including all health (hospital and community) and social care services. The interviews held at 12 months and 18 months post-partum recorded total service utilisation over the period since the last interview. The following information was recorded at each interview: the professional and agency that provided the service; its location; the frequency of use; and the duration of each service contact. Any misunderstandings about service encounters for either the woman or infant were resolved following discussion between the interviewer and each woman. All resource-use data were entered directly from the research instruments completed by the interviewers into a purpose-built data collection program with in-built safeguards against inconsistent entries and then verified by dual coding. Estimates of service provision were derived from these data and usually expressed in terms of contact hours. For all hospital admissions, estimates of service provision were expressed in terms of patient days, with part of a day at each level of care counted as a 24-hour period.

Unit costs

Unit costs for resources used by the women and infants who participated in the study were obtained from a variety of sources. All unit costs employed followed recent guidelines on costing health and social care services as part of economic appraisal (Drummond *et al*, 1997). The calculation of these costs was underpinned by the concept of opportunity cost. An average cost per hospital in-patient day was calculated using information made available by local hospital finance departments. All staff costs included salary information obtained from the finance departments, as well as national insurance costs, superannuation costs, other employer on-costs and revenue and capital overheads. Drug costs were obtained from the *British National Formulary* (British Medical Association & Royal Pharmaceutical Society of Great Britain, 2000). The unit costs of community health and social services were largely derived from national sources (Netten & Curtis, 2000), and took account of time spent by professionals on indirect activities such as travelling and paper work. However, the unit costs of some community health services were calculated from first principles using established accounting methods (Allen & Beecham, 1993). Unit costs were combined with resource volumes to obtain a net cost per mother–infant dyad over the study period. All costs are expressed in pounds sterling and valued at 2000 prices.

Statistical methods

A detailed statistical analysis plan was followed. First, women resident in Reading South who were randomised to receive the preventive intervention were compared with the remainder of the women in the study in order to establish whether receipt of the intervention significantly altered resource utilisation. It was established that women resident in Reading South receiving the preventive intervention received significantly more visits from their health visitor, but did not differ significantly in terms of any other aspect of resource utilisation. It was decided, therefore, to transpose the level of health visitor support received by these women with the mean number of health visitor contacts made by women resident in Reading South and allocated to receive routine primary care, and to test the implications of this assumption in a rigorous sensitivity analysis. Otherwise, all estimates of resource use incorporated into the baseline statistical analyses were derived from information provided by the women during the course of the interviews.

The primary analysis was of total costs, but results are also given by individual resource-use and cost components and by cost sector. Comparisons were made between groups of women according to whether they experienced post-natal depression or not at any time point, as measured by the SCID–II, and according to the number of times that post-natal depression was diagnosed. The statistical approach developed by Lin *et al* (1997) was used to simulate costs for 15 women for whom one of the economic questionnaires was not completed and whose responses could therefore be described as censored. This involved dividing the cost data-set into discrete periods and then applying the Kaplan–Meier method to estimate costs for each period on the basis of the uncensored cases. Costs accruing beyond the first year post-partum were reduced to present values using the 6% discount rate currently recommended for the public sector in Great Britain (National Institute for Clinical Excellence, 2001).

All results are reported as mean values with standard deviations, and mean differences in costs with 95% confidence intervals (CIs) where applicable. As the data for costs were skewed, in addition to Student *t*-tests of cost differences, assuming equality of variances, we used bootstrap estimation to derive 95% CIs of mean cost differences between the groups (Dixon, 1993). Each of these confidence intervals was calculated using 2000 bias-corrected bootstrap replications. Furthermore, a multiple regression model was constructed in order to identify clinical and socio-demographic predictors of economic costs. Total mother–infant dyad costs acted as the dependent variable in the regression model; a diagnosis of post-natal depression during the study period, maternal age, educational level, employment status, socio-economic status, living arrangements and the experience of problems with the partner, finance, accommodation and local area acted as explanatory variables. All analyses were performed with a microcomputer using the Statistical Package for the Social Sciences (SPSS version 7.5; SPSS Inc., Chicago, IL, USA) and SAS (SAS Institute Inc., Cary, NC, USA) software.

Sensitivity analysis

A series of multi-way sensitivity analyses was undertaken to explore the implication of uncertainty on the base-case cost estimates. Changes in four key variables were considered and the resulting effects on care costs were estimated. First, three alternative scenarios of community service utilisation were tested in response to a tendency, on the part of women, to underreport community service utilisation that had been revealed by an earlier pilot study (Petrou *et al*, 2002). In scenario 1, community service utilisation by the mother–infant dyads was assumed to be 10% greater than reported by the women. In scenario 2, community service utilisation by the mother–infant dyads was assumed to be 20% greater than reported by the women, whereas in scenario 3, community service utilisation was assumed to be 30% greater. Second, two alternative scenarios of per diem costs for in-patient care were tested to reflect variations in the relative price structures of resource inputs in other hospital settings (Drummond *et al*, 1997). In

https://doi.org/10.1192/bjp.181.6.505 Published online by Cambridge University Press

scenario 1, the per diem costs for in-patient care were assumed to be 20% less than those generated by our accounting methods. In scenario 2, the per diem costs for in-patient care were assumed to be 20% greater than those generated by our accounting methods. Third, two alternative scenarios of health visitor support provided to women in Reading South receiving the preventive intervention were tested. In scenario 1, the level of health visitor support was set at the mean number minus one standard deviation of health visitor contacts made by women in the Reading South control group. In scenario 2, the level of health visitor support was set at the mean number plus one standard deviation of health visitor contacts made by women in the Reading South control group. Finally, we tested the impact of four alternative discount rates (0%, 1.5%, 3% and 10%) that were applied to costs that accrued beyond the first year post-partum.

RESULTS

Study sample

A total of 2257 women were screened antenatally using the predictive index for post-natal depression, 403 of whom had index scores $\geqslant 24$ and were considered eligible for the study. Of these 403 women, 266 (66.0%) agreed to participate at the recruitment visit, 63 (15.6%) refused to participate at the recruitment visit, 48 (11.9%) could not be contacted, 23 (5.7%) were subsequently found to be ineligible and 3 (0.7%) were excluded for other reasons. An examination of the clinical and socio-demographic characteristics of the women who refused to participate at the recruitment visit or could not be contacted revealed that they tended to have higher predicted index scores than the women who agreed to participate, as well as being younger, more poorly educated and less likely to be in a stable relationship ($P<0.05$; Murray *et al*, 2000). Of the 266 women who agreed to participate at the recruitment visit, 206 (77.4%) subsequently completed at least two of the three interviewer-administered economic questionnaires and were included in the study. The remaining 60 women (22.6%) were found to be significantly younger ($P<0.01$), more poorly educated ($P=0.02$) and less likely to be in a stable relationship ($P=0.03$) than the 206 study participants.

Table 1 presents the baseline socio-demographic and clinical characteristics of the 206 study participants. The age profile of these women closely resembled national norms for new mothers (Macfarlane & Mugford, 2000). A total of 70 women were diagnosed with post-natal depression using the SCID–II at one or more time points during the study period: 34 were diagnosed at 8 weeks post-partum; 37 at 18 weeks post-partum; 28 at 12 months post-partum; and 18 at 18 months post-partum. Study participants with ($n=70$) and without ($n=136$) post-natal depression were similar in terms of the majority of baseline characteristics, with the exception of their educational qualifications ($P=0.01$) and degree of satisfaction with the area lived in ($P=0.03$).

Table 1 Baseline socio-demographic and clinical characteristics of study participants

Variable	Group	
	Study participants with post-natal depression ($n=70$)	Study participants without post-natal depression ($n=136$)
Maternal age, years (mean (s.d.))	29.1 (6.1)	29.2 (5.5)
Post-natal depression predictive score (mean (s.d.))	29.7 (4.3)	27.8 (3.0)
Educational qualifications (*n* (%))		
None	6 (8.6)	2 (1.5)
O levels, CSEs or GCSEs	24 (34.3)	47 (34.6)
A levels	1 (1.4)	17 (12.5)
Further qualifications	19 (27.1)	41 (30.1)
Degree	15 (21.4)	25 (18.4)
Higher degree	4 (5.7)	3 (2.2)
Missing	1 (1.4)	1 (0.7)
Length of time with current partner (*n* (%))		
No partner	3 (4.3)	5 (3.7)
Less than 1 year	5 (7.1)	18 (13.2)
1–2 years	18 (25.7)	19 (14.0)
2–5 years	15 (21.4)	39 (28.7)
More than 5 years	28 (40.0)	54 (39.7)
Missing	1 (1.4)	1 (0.7)
Satisfaction with area lived in (*n* (%))		
Very satisfied	15 (21.4)	55 (40.4)
Reasonably satisfied	45 (64.3)	65 (47.8)
Rather unsatisfied	6 (8.6)	13 (9.6)
Very unsatisfied	3 (4.3)	2 (1.5)
Missing	1 (1.4)	1 (0.7)
Health problems during index pregnancy (*n* (%))		
None	38 (54.3)	91 (66.9)
Yes, treated by general practitioner	19 (27.1)	29 (21.3)
Yes, required hospital admission	12 (17.1)	15 (11.0)
Missing	1 (1.4)	1 (0.7)
Experience of index pregnancy (*n* (%))		
Definitely positive	16 (22.9)	44 (32.4)
Mostly positive	45 (64.3)	83 (61.0)
Mostly not positive	7 (10.0)	7 (5.1)
Definitely not positive	1 (1.4)	1 (0.7)
Missing	1 (1.4)	1 (0.7)

https://doi.org/10.1192/bjp.181.6.505 Published online by Cambridge University Press

Costs

Resource-use values were combined with unit costs (Table 2) to generate estimates of mother–infant care costs between delivery and 18 months post-partum. Table 3 presents the mean costs and mean cost differences per mother–infant dyad through the duration of the study according to cost category and post-natal depression group. The arithmetic mean cost of community care provided to the mother was estimated at £786.20 for study participants with post-natal depression and £505.70 for study participants without post-natal depression: a mean cost difference of £280.50 that reached statistical significance (P=0.01). The arithmetic mean cost difference between the post-natal depression groups tended towards statistical significance for community mental health care

Table 2 Resource use and unit costs of resource items

Resource-use variable	Resource-use value (mean (s.d.))		Unit cost or range[1] (UK £ sterling, 2000 prices)
	Study participants with post-natal depression (n=70)	Study participants without post-natal depression (n=136)	
Mother: community care services			
Midwifery contacts	6.96 (9.18)	7.23 (4.97)	18.6 per contact hour[2]
General practitioner contacts	7.24 (4.85)	4.87 (3.18)	2.0–3.1 per contact minute[3]
Practice nurse contacts	1.14 (2.31)	0.99 (1.82)	21.0–27.0 per contact hour[3]
Practice counsellor contacts	0.76 (1.77)	0.29 (1.82)	21.0 per contact hour[3]
Health visitor contacts	6.32 (2.64)	6.63 (2.52)	57.0 per contact hour[4]
Home help contacts	0.03 (0.17)	0.07 (0.86)	10.1 per contact hour[3]
Social worker contacts	2.41 (10.10)	0.65 (3.59)	23.0 per contact hour[3]
Physiotherapist contacts	2.08 (5.44)	1.23 (2.99)	34.0 per contact hour[3]
Community psychiatric nurse contacts	3.01 (8.88)	1.27 (5.62)	56.0 per contact hour[3]
Community psychologist contacts	0.97 (4.29)	0.35 (2.04)	61.0 per contact hour[3]
Other community mental health contacts	0.44 (1.84)	0.21 (1.19)	56.0–61.0 per contact hour[3]
Other community care contacts	2.85 (7.88)	1.98 (6.80)	20.0–61.0 per contact hour[3,4]
Mother: day care services			
Day hospital attendances	0.24 (0.67)	0.24 (0.96)	17.0–25.0 per attendance[3]
Community-based day care attendances	0.03 (0.24)	0.16 (1.46)	17.0 per attendance[3]
Other day care attendances	0 (0.0)	0.08 (0.67)	17.0 per attendance[3]
Mother: hospital out-patients attendances			
Obstetric care attendances	0.15 (0.58)	0.13 (0.51)	51.3 per attendance[2]
Accident and emergency care attendances	0.16 (0.37)	0.20 (0.48)	60.5 per attendance[2]
Other out-patient attendances	1.05 (2.08)	0.75 (2.62)	53.0–353.0 per attendance[3]
Mother: hospital in-patient admissions			
Maternity ward admissions (days)	2.95 (2.55)	2.69 (2.28)	158.0 per day[2]
Mother and baby unit admissions (days)	0.1 (0.84)	0 (0.0)	158.0 per day[2]
Medical/surgical ward admissions (days)	0.21 (0.99)	0.26 (1.50)	182.0 per day[2]
Other hospital in-patient admissions (days)	0 (0.0)	0.02 (0.19)	127.0–345.0 per day[3]
Infant: paediatric and child care services			
Day nursery attendances	19.12 (40.39)	17.99 (38.80)	20.0 per attendance[3]
General practitioner contacts	8.54 (4.88)	7.04 (4.90)	2.0–3.1 per contact minute[3]
Community paediatrician contacts	0.20 (0.67)	0.21 (0.85)	97.0 per contact[3]
Hospital paediatrician contacts	1.05 (1.63)	1.20 (2.72)	97.0 per contact[3]
Accident and emergency care attendances	0.73 (1.22)	0.53 (0.83)	60.5 per attendance[2]
Special care baby unit admissions (days)	0.26 (0.90)	0.15 (0.57)	556.0 per day[2]
Paediatric ward admissions (days)	0.49 (1.21)	0.66 (2.07)	278.0 per day[2]
Physiotherapist contacts	0.07 (0.31)	0.26 (1.39)	34.0 per contact hour[3]
Other paediatric and child care contacts	0.74 (1.68)	1.09 (2.74)	34.0–59.0 per contact hour[3]

1. Ranges of unit costs are specified where unit costs varied according to location or intensity of care provided.
2. Local provider.
3. Netten & Curtis, 2000.
4. Primary research.

https://doi.org/10.1192/bjp.181.6.505 Published online by Cambridge University Press

Table 3 Mean costs and mean cost differences by cost category (UK £ sterling, 2000 prices)

	Study participants with post-natal depression (n=70)	Study participants without post-natal depression (n=136)	Mean difference	P[1]	Bootstrap mean difference	(95% CI)[2]
Mother: community care						
Community mental health care	273.9	113.3	160.5	0.07	158.5	(154.5–163.0)
Other community care	512.4	392.4	120.0	<0.01	120.0	(117.9–122.1)
Total community care	786.2	505.7	280.5	0.01	279.7	(274.8–285.2)
Mother: day care	8.5	7.4	1.0	0.77	1.0	(0.9–1.2)
Mother: hospital out-patient care	83.6	63.5	20.1	0.42	20.6	(19.6–21.6)
Mother: hospital in-patient care	521.9	473.5	48.4	0.50	46.7	(43.8–49.8)
Infant: paediatric and child care	1018.7	976.6	42.0	0.82	52.6	(45.1–60.9)
Total	2419.0	2026.9	392.1	0.17	388.2	(376.1–401.0)

1. P values calculated using Student t-test.
2. Bootstrap estimation using 2000 replications, bias corrected.

services (P=0.07) and reached statistical significance for other community care services (P<0.01). There were no statistically significant differences between study participants with and without post-natal depression in terms of the arithmetic mean cost of day care (P=0.77), hospital out-patient care (P=0.42) and hospital in-patient care (P=0.50) provided to the mother, and in terms of the arithmetic mean cost of paediatric and child care (P=0.82). The arithmetic mean mother–infant dyad cost was estimated at £2419.00 for study participants with post-natal depression and £2026.90 for study participants without post-natal depression (mean cost difference £392.10, P=0.17).

The cost of health and social care increased with the number of diagnoses of post-natal depression; the arithmetic mean cost difference increased from £354.40 when women with a diagnosis of post-natal depression at one time point was used as the reference group (P=0.33) to £824.70 when women with a diagnosis of post-natal depression at two time points was used as the reference group (P=0.09). In addition, the multiple regression analysis showed that, following adjustments for potentially confounding factors, a diagnosis of post-natal depression was associated significantly with total mother–infant dyad costs (P=0.04). All other variables incorporated into the multiple regression analysis, including maternal age, educational level, employment status, socio-economic status, living arrangements and the experience of problems with the partner, finance, accommodation and local area failed to show a significant association with total mother–infant dyad costs.

Sensitivity analysis

The effects of plausible variations in the values of variables over which there was a degree of uncertainty are presented in Table 4. Assuming that community service utilisation by the mother–infant dyads was greater than reported by the women had the effect of increasing the cost difference between the post-natal depression groups. The cost difference between women with and without post-natal depression increased by £28.10 (from £392.10 to £420.20) when community service utilisation was assumed to be 10% greater than reported by the women. The cost difference increased by £56.10 (from £392.10 to £448.20) when community service utilisation was assumed to be 20% greater than reported by the women and by £84.20 (from £392.10 to £476.30) when community service utilisation was assumed to be 30% greater. A 20% reduction and increase in the per diem cost for in-patient care had the effect of reducing and increasing the cost difference between the post-natal depression groups by £9.70. Reducing and increasing by one standard deviation the mean level of health visitor support provided to women in Reading South receiving the preventive intervention had the effect of increasing the cost difference between the post-natal depression groups by £7.50 and £9.80, respectively. Finally, variations in the rate at which costs that accrued beyond the first year post-partum were discounted to present values had a marginal effect, the largest of which was a £9.50 increase in the cost difference between the post-natal depression groups when these costs were left undiscounted. Simultaneous variation of the key economic variables did not significantly affect the results of the sensitivity analysis (data available from the authors upon request).

DISCUSSION

Study strengths

A search of the published medical, psychological and health economics literature by the authors suggests that this is the first study to estimate the economic implications of post-natal depression in any industrialised nation. The major strengths of this study are that it was based on a large cohort of women in a geographically defined area, and provided a comprehensive range of hospital and community health and social service data. These form a reliable basis for estimating the economic implications of post-natal depression. The study cost accounting was comprehensive and included all significant cost items, the values of which were calculated according to established principles in economic theory. Furthermore, the study sample size was large enough to detect a significant difference in the cost of community care between women with and without post-natal depression. Therefore, we would argue that the economic study was sufficiently sized to arrive at conclusions that

https://doi.org/10.1192/bjp.181.6.505 Published online by Cambridge University Press

Table 4 Sensitivity analysis of mean costs and mean cost differences (UK £ sterling, 2000 prices)

	Study participants with post-natal depression (n=70)	Study participants without post-natal depression (n=136)	Mean difference	P[1]	Bootstrap mean difference	(95% CI)[2]
Baseline analysis	2419.0	2026.9	392.1	0.17	388.2	(376.1–401.0)
Sensitivity analysis						
Community service utilisation						
10% greater than reported	2497.6	2077.4	420.2	0.15	426.4	(413.8–439.2)
20% greater than reported	2576.2	2128.0	448.2	0.13	444.3	(431.0–457.1)
30% greater than reported	2654.8	2178.6	476.3	0.12	474.0	(460.8–486.6)
Per diem costs for in-patient care						
20% less than accounting cost	2314.6	1932.2	382.4	0.16	384.3	(373.2–396.6)
20% greater than accounting cost	2523.3	2121.6	401.7	0.17	405.5	(393.3–417.4)
Health visitor contacts						
Mean in control group minus 1 s.d.	2415.4	2015.8	399.6	0.16	405.0	(393.3–416.4)
Mean in control group plus 1 s.d.	2461.2	2059.3	401.9	0.16	406.6	(395.2–418.5)
Discount rates						
0% for costs	2474.5	2072.9	401.6	0.17	394.0	(382.1–407.0)
1.5% for costs	2460.1	2061.0	399.1	0.17	387.7	(375.2–399.6)
3% for costs	2445.9	2049.2	396.7	0.17	397.1	(385.2–408.6)
10% for costs	2385.3	1999.0	386.4	0.16	384.0	(372.5–395.9)

1. P values calculated using Student t-test.
2. Bootstrap estimation using 2000 replications, bias corrected.

are both meaningful and relevant to decision-makers.

Study limitations

The study does have limitations, which should be borne in mind. By focusing on the cost of health and social care services provided to women and their infants, this study has adopted a public sector perspective. Adopting a broader, societal perspective would have allowed us to measure the direct non-medical costs (e.g. travel and child care costs), indirect costs (e.g. lost productivity) and intangible costs (e.g. costs of fear, pain and suffering) attributable to the condition. A second limitation is the 18-month time frame on which the economic study is based. Although the effects of post-natal depression are felt most acutely during the first 18 months post-partum, it is likely that the condition has longer-term consequences in terms of health status and health service utilisation over the mother's and infant's lifetime (Civic & Holt, 2000) and in terms of the child's educational requirements (Sinclair & Murray, 1998; Hay *et al*, 2001). If this is the case, then longer-term observational research is required to provide a complete assessment of the condition's economic implications. A third limitation relates to the focus of the economic study on women at high risk of developing post-natal depression. A separate audit of the health-seeking behaviour of women at low risk of developing post-natal depression, conducted in the same geographical area, showed that women not at high risk had fewer antenatal and post-natal hospital contacts and admissions than the study participants (Murray *et al*, 2000). This suggests that the high-risk population from which the study participants were drawn might be heavier users of public services than the primiparous population as a whole. However, there is no evidence to suggest that the mean difference in care costs between the post-natal depression groups (i.e. the costs that can be attributed to the condition) is affected by the selection of the study population. Another limitation is that the primary output of the statistical analyses was an incremental cost attributable to each case of post-natal depression, regardless of its duration. Secondary analyses showed that economic costs were heightened among women with more than one diagnosis of post-natal depression during the study period. As part of our future research, we hope to estimate the economic costs of post-natal depression by overall duration of experience. A final limitation is that the number of health visitor contacts made by approximately one-half of the women resident in Reading South was affected by participation in a randomised controlled trial and had to be transposed with an alternative estimate of health visitor contacts. However, the cost of health visitor support formed less than 1% of total public sector costs. Furthermore, a rigorous sensitivity analysis revealed that the assumed level of health visitor contacts had a marginal effect on overall care costs and cost differences between the post-natal depression groups (Table 4). Therefore, we are confident that the assumption made does not diminish the validity of the study conclusions.

Policy and research implications

Despite the limitations of our study, the results have important implications for

https://doi.org/10.1192/bjp.181.6.505 Published online by Cambridge University Press

service providers. The study generated a mean cost differential involving health and social care of £392.10 between women with and without post-natal depression. Given that approximately 700 000 women give birth in Great Britain each year (Macfarlane & Mugford, 2000) and that approximately 13% of these women will subsequently experience post-natal depression (O'Hara & Swain, 1996), these data suggest that the national economic burden of the condition to the public services amounts to approximately £35.7 million per annum (sensitivity analysis range £34.4–£43.3 million). Furthermore, the economic costs of post-natal depression are heightened among women with extended experiences of the condition. It is imperative that public sector providers recognise the overall economic impact of the condition in their service planning and that particular care is taken to target services at the psychologically vulnerable.

The prevention of mental health problems in the perinatal period and their deleterious consequences is regarded as a priority both politically (Secretary of State for Health, 1998) and professionally (Royal College of Paediatrics and Child Health, 1998). The British Government has published a number of documents that emphasise the need for effective strategies for preventing mental health problems during this period (Home Office, 1998; Department of Health, 2000). In recent years, the efficacy of a number of secondary prevention interventions for post-natal depression has been demonstrated by randomised controlled trials (Holden *et al*, 1989; Appleby *et al*, 1997; O'Hara *et al*, 2000). In addition, studies of a number of primary prevention interventions show promising results, but these remain to be tested in trials that are appropriately sized and comply with internationally accepted design and reporting guidelines. A feature of all the studies aimed at preventing or alleviating the effects of post-natal depression is their failure to collect detailed economic information and, therefore, to assess the cost-effectiveness of the interventions. It is imperative that economic evaluations of these interventions are conducted and that resources in this area are allocated in a manner that is both clinically and cost effective.

CLINICAL IMPLICATIONS

- The economic costs of post-natal depression can be considerable and are borne primarily by community service providers.
- The results of this study should enable forecasts to be made about the use and cost of services provided by health and social care agencies.
- The results of this study should help the development of future economic evaluations of prevention and treatment strategies.

LIMITATIONS

- The study excluded the direct non-medical costs, indirect costs and intangible costs attributable to the condition.
- The longer-term consequences of post-natal depression in terms of health status and service utilisation over the mother's and infant's lifetime might not have been addressed.
- The health-seeking behaviour of the study participants might not be typical of new mothers in Great Britain.

STAVROS PETROU, PhD, National Perinatal Epidemiology Unit, University of Oxford, UK; PETER COOPER, PhD, LYNNE MURRAY, PhD, Department of Psychology, University of Reading UK; LESLIE L. DAVIDSON, MD, National Perinatal Epidemiology Unit, University of Oxford, UK

Correspondence: Dr Stavros Petrou, National Perinatal Epidemiology Unit, Institute of Health Sciences, University of Oxford, Old Road, Headington, Oxford OX3 7LF, UK. Tel: +44 (0) 1865 226829; fax: +44 (0) 1865 227002; e-mail: stavros.petrou@perinat.ox.ac.uk

(First received 8 May 2002, final revision 16 July 2002, accepted 31 July 2002)

ACKNOWLEDGEMENTS

We would like to thank Claire Lawson, Matt Woolgar, Helena Romaniuk, Christine Hockley, Jackie Peters, Liz Schofield, Liz Andrews, Wendy Vince and Simon Gates for their contributions to the data collection and data analysis. We also thank the anonymous referees for their comments on an earlier draft of this paper. The views contained in this paper are those of the authors and not necessarily those of the funding bodies.

REFERENCES

Allen, C. & Beecham, J. (1993) Costing services: ideals and reality. In *Costing Community Care: Theory and Practice* (eds A. Netten & J. Beecham), pp. 25–42. Aldershot: Ashgate Publishing.

Appleby, L., Warner, R., Whitton, A., *et al* (1997) A controlled study of fluoxetine and cognitive behavioural counselling in the treatment of postnatal depression. *BMJ*, **314**, 932–936.

British Medical Association & Royal Pharmaceutical Society of Great Britain (2000) *British National formulary* (September). London & Wallingford: BMJ Books & Pharmaceutical Press.

Civic, D. & Holt, V. L. (2000) Maternal depressive symptoms and child behavior problems in a nationally representative normal birthweight sample. *Maternal and Child Health Journal*, **4**, 215–221.

Cogill, S. R., Caplan, H. L., Alexandra, H., *et al* (1986) Impact of maternal postnatal depression on cognitive development of young children. *BMJ*, **292**, 1165–1167.

Cooper, P. & Murray, L. (1996) *Preventative Intervention for Postpartum Depression, Associated Difficulties in the Mother–Infant Relationship, and Adverse Infant Outcome.* London: National Health Service Executive.

___, ___ & Stein, A. (1993) Psychosocial factors associated with the early termination of breastfeeding. *Journal of Psychosomatic Research*, **37**, 171–176.

___, ___, Hooper, R., *et al* (1996) The development and validation of a predictive index for postpartum depression. *Psychological Medicine*, **26**, 627–634.

Department of Health (2000) *Saving Lives: Our Healthier Nation.* London: Stationery Office.

Dixon, P. M. (1993) The bootstrap and the jackknife: describing the precision of ecological indices. In *Design and Analysis of Ecological Experiments* (eds S. M. Scheiner & J. Gurevitch), pp. 290–318. New York: Chapman and Hall.

Drummond, M. F., O'Brien, B., Stoddart, G. L., *et al* (1997) *Method for the Economic Evaluation of Health Care*

https://doi.org/10.1192/bjp.181.6.505 Published online by Cambridge University Press

Programmes (2nd edn). Oxford: Oxford University Press.

First, M. B., Spitzer, R. L., Gibbon, M., *et al* (1995) The Structured Clinical Interview for DSM–III–R personality disorders (SCID–II). I. Description. *Journal of Personality Disorders*, **9**, 83–91.

Godfroid, I. O. & Charlot, A. (1996) La psychiatrie du post-partum. *Revue Médicale de Bruxelles*, **17**, 22–26.

Hay, D. F., Pawlby, S., Sharp, D., *et al* (2001) Intellectual problems shown by 11-year-old children whose mothers had postnatal depression. *Journal of Child Psychology and Psychiatry*, **42**, 871–889.

Holden, J. M., Sagovsky, R. & Cox, J. L. (1989) Counselling in a general practice setting: controlled study of health visitor intervention in treatment of postnatal depression. *BMJ*, **298**, 223–226.

Home Office (1998) *Supporting Families*. London: Stationery Office.

Lin, D. Y., Feuer, E. J., Etzioni, R., *et al* (1997) Estimating medical costs from incomplete follow-up data. *Biometrica*, **53**, 113–128.

Macfarlane, A. & Mugford, M. (2000) *Birth Counts: Statistics of Pregnancy and Childbirth*. London: Stationery Office.

Murray, L. (1992) The impact of postnatal depression on infant development. *Journal of Child Psychology and Psychiatry*, **33**, 543–561.

___, Sinclair, D., Cooper, P., *et al* (1999) The socioemotional development of 5-year-old children of postnatally depressed mothers. *Journal of Child Psychology and Psychiatry*, **40**, 1259–1271.

___, Woolgar, M. & Cooper, P. (2000) *Process in the Failure to Provide Optimal Care to Vulnerable Women in the Puerperium. Access to Healthcare by Low Risk and High Risk Women*. London: National Health Service Executive South East.

National Institute for Clinical Excellence (2001) *Technical Guidance for Manufacturers and Sponsors on Making a Submission to Technology Appraisal*. London: National Institute for Clinical Excellence.

Netten, A. & Curtis, L. (2000) *Unit Costs of Health and Social Care*. Canterbury: Personal Social Services Research Unit, University of Kent.

O'Hara, M. W. & Swain, A. M. (1996) Rates and risks of postpartum depression – a meta-analysis. *International Review of Psychiatry*, **8**, 37–54.

___, Stuart, S., Gorman, L. L., *et al* (2000) Efficacy of interpersonal therapy for postpartum depression. *Archives of General Psychiatry*, **57**, 1039–1045.

Petrou, S., Murray, L., Cooper, P., *et al* (2002) The accuracy of self-reported health care resource utilisation in health economic studies. *International Journal of Technology Assessment in Health Care*, **18**, 705–710.

Royal College of Paediatrics and Child Health (1998) *Strategy for the Millennium*. London: Royal College of Paediatrics and Child Health.

Secretary of State for Health (1998) *Our Healthier Nation: A Contract for Health*. London: Stationery Office.

Seeley, S., Murray, L. & Cooper, P. J. (1996) Postnatal depression: the outcome for mothers and babies of health visitor intervention. *Health Visitor*, **69**, 135–138.

Sinclair, D. & Murray, L. (1998) Effects of postnatal depression on children's adjustments to school. Teacher's reports. *British Journal of Psychiatry*, **172**, 58–63.

Stein, A., Gath, D. H., Bucher, J., *et al* (1991) The relationship between post-natal depression and mother–child interaction. *British Journal of Psychiatry*, **158**, 46–52.

https://doi.org/10.1192/bjp.181.6.505 Published online by Cambridge University Press